Hudson,

OPERATING INSTRUCTIONS

MODEL TTS 39BAE REFERENCE TONE GENERATOR

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MODEL TTS 39BAE
REFERENCE TONE GENERATOR

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MODEL TTS 39BAE

REFERENCE TONE GENERATOR

1.0 GENERAL DESCRIPTION

1.01 The Model TTS 39BAE consists of a basic unit which includes a transistorized oscillator delivering a constant output level. Four independent output modules, designated as Model TTS 39XA, are also supplied. One of these output units, designated as output #4, has been arranged to provide ON HOOK-OFF HOOK cycling, i.e., 10 seconds OFF HOOK and one second ON HOOK. All four output circuits have been strapped at the factory to provide an output impedance of 900 ohms.

1.02 The output stages are completely independent of one another; trouble in one output has no effect on the other outputs. No damage will result if ringing voltage is applied to an output.

1.03 The Model TTS 39BAE is also equipped with a time cycle generator, which provides a ground contact at regular time intervals, for the purpose of ON HOOK-OFF HOOK cycling of the #4 output circuit.

1.04 Each Model TTS 39XA Output Amplifier Module is provided with a test jack to monitor the output level. The insertion of a test cord in these jacks disconnects the output from the connector appearance.

2.0 TRANSMISSION PERFORMANCE

GENERAL

2.01 Because of the basic temperature sensitivity of semiconductors the following specifications are intentionally conservative. Representative sets show substantially better performance than that specified. In most installations the temperature variations are relatively small; consequently, the variations in performance are very small.

Output Frequency:		1000 cps
Frequency Tolerance:		±1%
Harmonic Distortion		
Temperature:	50° -110 F	not more than 1.0%
	30° -120 F	not more than 2.0%
Output Level:		
	Nominal	0 dbm
	Maximum	+2.0 dbm
	Minimum	-1.0 dbm
Output Level Variations:		
Temperature:	50° -110 F	not more than 0.10 db
	30° -120 F	not more than 0.20 db
Voltage	42 - 50 Volts	not more than 0.05 db
Current Drain:	MAX 500 MA	
Size:	5 1/4" x 19"	

3.0 CONTROLS AND ADJUSTMENTS

3.01 The following controls and jacks appear on the front panel of the TTS 39BAE:

1. Power switch and indicator lamp
2. OSC TEST - monitor oscillator
3. TEST jack for TTS 39XA Output Amplifier Modules
4. COARSE level adjustment (locking) for TTS 39XA Output Amplifier Modules
5. Fine level adjustment (locking) for TTS 39XA Output Amplifier Modules.

3.02 It is necessary to allow at least a half hour warm-up period before any level adjustments are made. This amount of time is required for the temperature controlled oven containing the level stabilization element to reach its operating temperature. Normal output for units which have been adjusted for 0 dbm output will be in the order of +2.5 dbm when first turned on. This will decrease and stabilize at 0 dbm when the oven reaches its operating temperature. Level adjustments can be made with the COARSE and FINE adjustment, but this adjustment is to be made only after the oven has reached its operating temperature.

4.0 CIRCUIT DESCRIPTION

A. Basic Panel

4.01 The schematic diagram to which the following description applies is shown in Figure 1.

4.02 The TTS 39BAE basic panel contains the terminals, wiring, oscillator and associated circuitry necessary to accommodate four TTS 39XA Output Amplifier Modules.

4.03 Common fusing, power switching, and reverse voltage protection are supplied by fuse F-1, power switch S-1 and diode CR-1. A "power on" indication is supplied by pilot lamp PL-1.

4.04 Voltage division for the level stabilizing oven unit is supplied by resistor R-31. Capacitor C-1 provides spark suppression for the thermostat switching contacts located with the oven unit. The DC voltage at pin 3 of the oven should read 24 volts when heating.

4.05 Decoupling between the battery supply and the tone generator is supplied by resistor R-35 and capacitor C-2. Resistors R-32, R-34, and capacitor C-3 provide voltage division and filtering for the oscillator amplifier unit.

4.06 The OSC TEST jack provides access to the output of the oscillator amplifier unit.

CAUTION: Damage to the thermistor within the oven unit may result should high AC or DC voltages be applied to the OSC TEST jack.

4.07 DC blocking between the output of the oscillator amplifier unit and an external Model TTS 39D Distribution Amplifier Panel (optional) is provided by capacitor C-4. This circuit is extended to terminal 12 of terminal board TB-1.

4.08 Terminals A through G of terminal board TB-1 provide the internal connections to the Model TTS 39XA Output Amplifier Modules. These connections include battery, ground, signal input, and control circuits.

B. Oscillator Amplifier Circuit

4.09 The circuit diagram to which the following description applies is shown on Figure 2. A component placement diagram is shown on Figure 2A.

4.10 A bridged-T type of R-C oscillator, consisting of three transistor stages, is used. The first two transistors are directly coupled from the collector of Q-1 to the base of Q-2. The positive feedback path is completed from the emitter of Q-2 back through a blocking condenser and a tungsten lamp, utilized for level stabilization, to the emitter of Q-1. A part of the emitter resistance of Q-1 has been made variable to allow setting the correct amount of positive feedback necessary for stable operation.

4.11 A negative feedback which is greater than the positive feedback is supplied to the base of Q-1 through a null selective network and an emitter follower. At its tuned frequency the selective bridged-T null network decreases the negative feedback sufficiently to permit oscillation to occur at the desired frequency, which is determined by the R-C values employed within the network. This frequency determining network consists of two padded capacitances, C-4, and C-5 and two selected resistors.

4.12 Amplifier stage Q-4 and the cascaded emitter follower stages Q-5 and Q-6 provide the necessary voltage and current gain required to drive the thermistor Tx, located within the special temperature oven, onto its voltage maximum or "hump". The output level of the amplifier stage driving the thermistor is determined by the setting of potentiometer R-19. Capacitor C-7 provides DC blocking between the output emitter follower Q-6 and the thermistor.

C. Output Amplifier

4.13 The Model TTS 39XA Output Amplifier Module consists of an input attenuator, a highly stabilized buffer amplifier and one emitter follower stage coupled to an output transformer providing a balanced output. These units can be strapped in the field for either 600 or 900 ohm operation. Output levels are adjustable over a range from -1 dbm to +2 dbm. The circuit diagram to which the following description applies is shown on Figure 3. A component location diagram is shown on Figure 3A.

4.14 The input from the common oscillator unit is coupled to the Q-1 buffer amplifier stage through the attenuator circuit consisting of potentiometers R-4, R-14 and fixed resistors R-1, R-5 and R-14A. These controls provide the COARSE and FINE adjustment of the output level. Capacitor C-1 provides DC blocking for the base circuit of Q-1. The output of the Q-1 buffer amplifier stage appears across the collector load resistor R-3 and in turn is DC coupled to the emitter follower stage Q-2. The signal voltage, appearing across the R-13 emitter load resistor of transistor Q-2 is coupled to output transformer T-1 through DC blocking capacitor C-2. Precision resistors, R-8 and R-9, provide the impedance buildout for either 600 or 900 operation. The 600 ohm condition exists when resistor R-9 is strapped out of the circuit over terminals marked Z. Capacitor C-3 provides DC blocking for the output circuit. Capacitor C-5 eliminates any possibility of high frequency oscillations.

4.15 The output of transformer T-1 is coupled to terminals 1 and 2 of the terminal board located on the rear of the module. This circuit is carried over contacts of the test jack. When plugged into the test jack all external circuits are disconnected by the interrupter springs of the test jack.

4.16 Resistors R-10, R-11, and capacitor C-4 provide voltage division and filtering for the output amplifier circuit. Resistor R-12 serves as the sleeve resistance to battery for the external circuit connected to the module.

D. Time Cycle Generator

4.17 The Model TTS 39BAE also contains a time cycle generator as standard equipment. This unit provides the time base for the cycling of ON and OFF HOOK supervision provided on the #4 output module.

4.18 Start ground for the time cycle generator is derived through an isolating diode from the sleeve circuit of the #4 output amplifier module.

4.19 A schematic diagram of the time cycle generator circuit is shown on Figure 4. A component placement diagram is shown on Figure 4A, of this manual. The operation of the Time Cycle Generator is as follows:

4.20 When ground is applied to start lead S of the generator circuit, capacitor C-1 in the base circuit of transistor Q-1, will charge over the break contacts of relay K2 and resistor R-6 to the regulated voltage appearing at the junction of R-1 and zener diode CR-2. Relay K-1, which is in the emitter circuit of Q-1, will operate when the base voltage of Q-1 has risen to approximately 8 volts. The selected value of R-6 determines the rise time and is selected to produce a time constant of 1 second. Relay K-1, when operated, interrupts the ground circuit to terminal G over its make contacts 4 and 5. Terminal G is part of TB-1 of the basic panel shown on Figure 1.

4.21 K-1, operated, also energizes relay K-2. Relay K-2, when operated, interrupts the charging circuit from battery via R-6 to C-1 and establishes a circuit from ground through R-5, its make contacts 3 and 4 to capacitor C-1, which will slowly discharge capacitor C-1. The time required to discharge C-1 is determined by the selected value of R-5. R-5 has been selected to provide a discharging time constant of 10 seconds. After C-1 has discharged sufficiently to allow K-1 to release, ground is again applied to terminal G and the charging circuit for C-1 re-established.

4.22 Relay K-1 while released causes relay INT to operate, INT is located on the #4 output module. INT, while operated, opens the RING circuit to the circuit connected to the #4 output module thus, while INT is operated, an ON HOOK condition is established.

5.0 MAINTENANCE AND TROUBLE SHOOTING

GENERAL

5.01 Apart from occassional checks on the output levels, the TTS 39BAE units do not require any routine maintenance.

5.02 If any abnormal operation occurs, it can easily be traced to one of the three groups of circuits. These circuits are as follows:

1. Oscillator and thermistor driving circuit.
2. Output amplifier circuits.
3. Time cycle generator circuit

5.03 When there is no output at any of the output amplifiers, the trouble is most likely to be located in the oscillator and thermistor driving circuits and trouble shooting should be conducted as follows:

1. Referring to Fig. 2A, connect the high side of a VTVM to point A and the low side to the low side of resistor R-90 (ground) on the oscillator board. The voltage should be 1.5 volts RMS at these points. If it is not, adjust R-15 for this level. Turning R-15 with a screwdriver clockwise increases the positive feedback and therefore increases the output level appearing at point A. There should be no fluctuation of the signal level at this point once the level is adjusted to 1.5 volts RMS.

2. If there is no voltage between point A and ground (with R-15 in maximum clockwise position), check the filament of the tungsten lamp for continuity. Replace if faulty. If the lamp is good, replace the transistors, starting with Q-1 and ending with Q-3. If trouble still prevails, check for proper DC voltage as indicated on the schematic diagram of the circuit. These voltages should be within ±10% as indicated.

3. When the preceding steps fail to produce an output at point A, check other components contained in the oscillator circuit, such as resistors, capacitors, and the frequency switching relays. It is important after correction of the trouble to readjust the voltage appearing at point A and ground to 1.5 volts RMS.

5.04 With the oscillator operating properly, check the RMS voltage appearing between pin 2 and 7-8 of the oven. This voltage should be in the order of 1.1 volts RMS; the exact voltage depends upon the characteristics of the individual thermistor within the

oven itself. The oven must be at normal operating temperature for this measurement. If no voltage appears at pin 2 of the oven, check the thermistor driving portion of the circuit. This circuit consists of transistors Q-4, Q-5, Q-6 and their associated circuitry. After this circuit has been restored to normal operating condition check the operating point of the thermistor. This is covered under Thermistor Operating Level Adjustment.

5.05 If the voltage appearing across the thermistor (between pins 2 and 7 of the oven) is found to be excessive, check the thermistor for continuity as this indicates an open thermistor. If the thermistor is found to be defective, installation of a new oven unit is recommended.

Thermistor Operating Level Adjustment

5.06 The thermistor driving voltage has been factory adjusted and should require further adjustment only when replacement of the oven unit has become necessary. For this adjustment the oven must be at its normal operating temperature and the oscillator voltage appearing at the emitter of Q-2 should be 1.5 volts RMS. Refer to Fig. 2A for the preceding component locations.

5.07 To perform the thermistor level adjustment, remove the protective front cover and connect the high side of a VTVM to the emitter of Q-6 (2N1136A) and the low side to ground. Connect an output level meter such as a Model TTS 4A or equivalent into one end of the test jacks. Advance adjustable resistor R-19 (located on the oscillator board) to a full clockwise position. Observe the output level and very slowly rotate R-19 in a counter clockwise direction to a point where the output level no longer continues to rise as R-19 is turned. If necessary, repeat the preceding operation in order to definitely establish this point. The thermistor is now being driven to the beginning of its so called "hump". Observe the VTVM which should now show a reading of approximately 4 to 5 volts RMS (the exact voltage depends on the characteristics of the individual thermistor), and further rotate R-19 to a position that increases the VTVM reading by 1 volt.

Output Amplifier

5.08 When one output circuit is inoperative and the others are functioning normally, it can be assumed that the preceding oscillator and thermistor driving circuit is operating satisfactorily. Trouble shooting should be conducted on the inoperative output stage as follows:

1. With reference to Fig. 3A, substitute transistors Q-1 and Q-2, then recheck for output. If trouble still exists, advance both output level controls (COARSE and FINE) to their full clockwise position. With the unit on, check the DC voltage at the negative end of capacitor C-4, it should read 24 volts DC ±10%.

Connect the high side of a VTVM to the junction of R-2 and R-6 (base of Q-1) and the low side to ground. The AC signal voltage at this point should be in the order of .5 volts RMS. If it is not, trouble will probably be found in the output level adjustment controls or the DC blocking capacitor C-1. Excessive output level is an indication of an open resistor or defective oven unit.

2. If the signal voltage measured at the base of Q-1 is found to be normal, measure the signal voltages appearing at the collector of Q-1 and the emitter of Q-2. The AC signal voltages at these points should be in the order of 2.8 volts RMS. If these voltages are found to be normal, connect the high side of the VTVM to terminal 4 (green lead) of transformer T-1 and the low side to terminal 1 (black and white lead) of transformer T-1. The AC signal voltage should read in the order of 2.8 volts RMS (no load on output). If no signal appears at this point, check DC blocking capacitor C-3 and transformer T-1 for an open circuit. If the signal voltage measured is low and capacitor C-3 is found to be normal, check transformer T-1 for shorted turns by measuring the DC resistance of the windings. With the transformer in the circuit (power removed from the unit), the following resistances should be realized; if they are not, replace the transformer.

Terminal 5 to Terminal 8	40-60 ohms
Terminal 1 to Terminal 2	20-30 ohms
Terminal 3 to Terminal 4	20-30 ohms

The above readings are approximate and will vary with individual transformers.

3. Should the signal voltage measured at terminals 1 and 4 of T-1 be normal, then capacitor C-3 and resistors R-8 and R-9 should be checked. Contacts of test jack J-1 must make a good connection in order for the signal to reach the ring and tip contacts on the terminal board. No signal should appear on the terminal board when a plug is inserted into the test jack.

4. After trouble has been corrected, readjust the COARSE and FINE adjustment controls to the desired output level. Oven must be at normal operating temperature for this adjustment.

Time Cycle Generator

5.09 Should the Time Cycle Generator unit fail to operate, after applying ground to the start (S) terminal, the trouble will most likely be traced to dirty relay contacts. If the unit does

not operate after cleaning, the contacts of K-1, and K-2, other components such as Q-1, C-1, CR-1 and R-1 through R-6 should be checked.

5.10 The value of resistor R-6 determines the charge time of C-1 and the value of resistor R-5 determines the discharge time of C-1. These values have been selected to provide an operate time of 10 seconds. Any change in the values of C-1, R-5, or R-6 will change the timing of the unit.

6.0 INSTALLATION INSTRUCTIONS

6.01 Before attempting to connect and operate the Model TTS 39BAE Reference Tone Generator, perform a visual inspection of the unit to insure that damage has not been caused during shipment, such as components being pushed together, etc.

6.02 Installers wiring and inter-connection is shown on the Installation Diagram Figure 5.

6.03 Connect a well filtered 48 volt DC source to terminals 1 and 2 of terminal board TB-1, located on the rear of the unit. Positive (+) is to be connected to terminal 2 and negative (-) to terminal 1. If polarity is reversed the unit will not operate, but there will be no damage to any components.

6.04 The unit is designed to operate over a voltage range of 44 to 52 volts at terminals 1 and 2. A direct line to the DC buss should be provided. If this is not feasible, thorough tests must be made to insure that the supply voltage at terminals 1 and 2 will always be within this range regardless of the other loads which may be connected to or disconnected from the common supply line.

6.05 Each of the TTS 39XA Input Amplifier Modules of the TTS 39BAE is normally connected to an especially assigned subscriber number in the dial equipment. The line circuits normally associated with these subscriber appearances must be disconnected. This is necessary to avoid a permanent off-hook condition in the line circuit, and to remove all DC voltages from the R, T leads when the TTS 39BAE is in the idle condition.

6.06 The tip, ring and sleeve of each subscriber number assigned to the TTS 39BAE should be connected to terminals 1, 2 and 8 respectively on each TTS 39XA Output Amplifier Module.

6.07 Each TTS 39XA Output Amplifier Module can be arranged for either 900 or 600 ohm output impedance. Installation diagram Figure 5 shows the correct strap to be added or deleted for the 600 or 900 ohm impedance.

6.08 Should the impedance of a TTS 39XA be changed in the field, the level should be readjusted to meet the correct requirements. Before attempting the above level adjustments it is important to allow a half hour warm-up period, as this period of time is required for the temperature controlled oven to reach operating temperature.

MODEL TTS 39BAE
REFERENCE TONE GENERATOR

TABLE OF REPLACEABLE PARTS

Circuit Ref	Over All Parts Description	Mfr* & Mfr's Designation	
R31	Resistor: Fixed, w.w. 100 ohm 5% 5w	243E1015	I
R32	Resistor: Fixed, w.w. 1.2K 3w	PW-3	M
R34	Resistor: Fixed w.w. 600 ohm 10% 3w	PW-3	M
R35	Resistor: Composition 100 ohm 5% 1/2w		B
C1	Capacitor: Fixed Disc .01 mfd 600 vdc	1D-.01	F
C2	Capacitor: Fixed Electrolytic 100 mfd 50vdc	TVA 1310	L
C3	Capacitor: Fixed Electrolytic 100 mfd 50vdc	TVA 1310	P
C4	Capacitor: Fixed Electrolytic 20 mfd 25vdc	APD-046	L
CR1	Diode: Silicon	1N2069	I
Tx	Thermistor	32A3	V
Oven	24V-55° Thermistor Unit	NE-62	F
S1	ON-OFF Switch SPST	20994-LH	A
PL-1	Pilot Light Assembly	105-4428-722	I
Lamp	48 Volt	55C	I
F1	Fuse Holder	HKP	E
Fuse	1 Amp	3AG-1A	W
TB1	2-13 position strips	13-140 3/4w	G
J1	Oscillator test jack	L 12B	Q

Time Cycle Generator

Circuit Ref	Description	Mfr* & Mfr's Designation	
R1	Resistor: Fixed Composition 5.1K 5% 1/2w		B
R2	Resistor: Fixed Composition 1.8K 5% 1w		B
R3	Resistor: Fixed Composition 1.2K 10% 1w		B
R4	Resistor: Fixed Composition 2.2K 5% 1/2w		B
R5	Selected Value		
R6	Selected Value		
C1	Capacitor: Fixed Electrolytic 100mfd 20vdc	APD-095	L
CR1	Diode: Silicon	1N2069	R
CR2	Diode: Regulator, Silicon	1N769	U
Q1	Transistor	2N1375	S
K1	Relay 2500 ohm coil	RS5D	O
K2	Relay 2500 ohm coil	RS5D	O

Oscillator Board

Circuit Ref	Description	Mfr* & Mfr's Designation	
R14	Resistor: Fixed composition, 47K 5% 1/2w		B
R15	Resistor: Variable 400 ohm	CM22425	H
R16	Resistor: Fixed Composition 220 ohm 5% 1/2w		B
R17	Resistor: Fixed Composition 3.3K 5% 1/2w		B
R18	Resistor: Fixed Composition 220 ohm 5% 1/2w		B
R19	Resistor: Variable 400 ohm	CM22425	H
R20	Resistor: Fixed Composition 1K 5% 1/2w		B
R21	Resistor: Fixed Composition 100K 5% 1/2w		B
R22	Resistor: Fixed Composition 100K 5% 1/2w		B
R23	Resistor: Fixed Composition 10K 5% 1/2w		B
R24	Resistor: Fixed Composition 27K 5% 1/2w		B
R25	Resistor: Fixed Composition 300K 5% 1/2w		B
R26	Resistor: Fixed Composition 750 ohm 5% 1/2w		B
R27	Resistor: Fixed Composition 10K 5% 1/2w		B
R28	Resistor: Fixed Composition 6.2K 5% 1/2w		B
R29	Resistor: Fixed Composition 1.5K 5% 1w		B
R30	Resistor: Fixed Composition 620 ohm 5% 1/2w		B
R33	Resistor: Fixed Composition 1K 5% 1w		B
R89	Lamp, Tungston 4w 120V	T4-1/2	K
R90	Resistor: Fixed Composition 10K 5% 1/2w		B
C1	Capacitor: Fixed Electrolytic 20mfd 25VDC	APD-046	L
C2	Capacitor: Fixed Electrolytic 20mfd 25VDC	APD-046	L

Oscillator Board (cont'd)

Circuit Ref	Description	Mfr* & Mfr's Designation	
C3	Capacitor: Fixed Electrolytic 20mfd 25VDC		L
C4	Capacitor: Fixed Paper .01mfd 100VDC	194P1035	P
C5	Capacitor: Fixed Paper .01mfd 100VDC	194P1035	P
C6	Capacitor: Fixed Electrolytic 20mfd 25VDC	APD-046	L
C7	Capacitor: Fixed Electrolytic 20mfd 50VDC	TE 1305	P
C9	Capacitor: Fixed Electrolytic 100mfd 50VDC	APD-127	L
Q1-Q5	Transistors	2N 1375	S
Q6	Power Transistor	2N 1136A	D
	Printed Circuit Board (Osc)	E95026	J

Output Modules 1-2-3 & 4 Model A

Circuit Ref	Description	Mfr* & Mfr's Designation	
	Printed Circuit Board	E 95025	J
R1	Resistor: Fixed Composition 3.9K 5% 1/2w		B
R2	Resistor: Fixed Composition 4.7K 5% 1/2w		B
R3	Resistor: Fixed Composition 220K 5% 1/2w		B
R4	Resistor: Variable 5K	CM29064NP	H
R5	Resistor: Fixed Composition 4.7K 5% 1/2w		B
R6	Resistor: Fixed Composition 10K 5% 1/2w		B
R7	Resistor: Fixed Composition 820 ohm 5% 1/2w		B
R8	Resistor: Fixed Composition 442 ohm 1% 1/2w	CEC-TO	M
R9	Resistor: Fixed Composition 307 ohm 1% 1/2w	CEC-TO	M
R10	Resistor: Fixed Wirewound 1.2K 10% 3w	PW-3	M
R11	Resistor: Fixed wirewound 900 ohm 10% 3w	PW-3	M
R12	Resistor: Fixed wirewound 1.2K 10% 3w	PW-3	M
R13	Resistor: Fixed Composition 2.2K 5% 1/2w		B
R17	Resistor: Variable 5K	CM29064NP	H
R17A	Resistor: Fixed Composition 2.2K 5% 1/2w		B
C1	Capacitor: Fixed Electrolytic 20mfd 25VDC	APD-046	L
C2	Capacitor: Fixed Paper 2.0mfd 150VDC	121P20591R5S4	P
C3	Capacitor: Fixed Paper 2.0mfd 150VDC	121P20591R5S4	P
C4	Capacitor: Fixed Electrolytic 100mfd 50VDC	APD-127	L
C5	Capacitor: Fixed Disc .001mfd 600VDC	DD-102	F
Q1	Transistor	2N 1374	S
Q2	Transistor	2N 1375	S
T1	Line to Line Transformer	S-58X	T
J1	Output Jack	54-SF	Q

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Output Modules 1-2-3 & 4 Model A (cont'd)

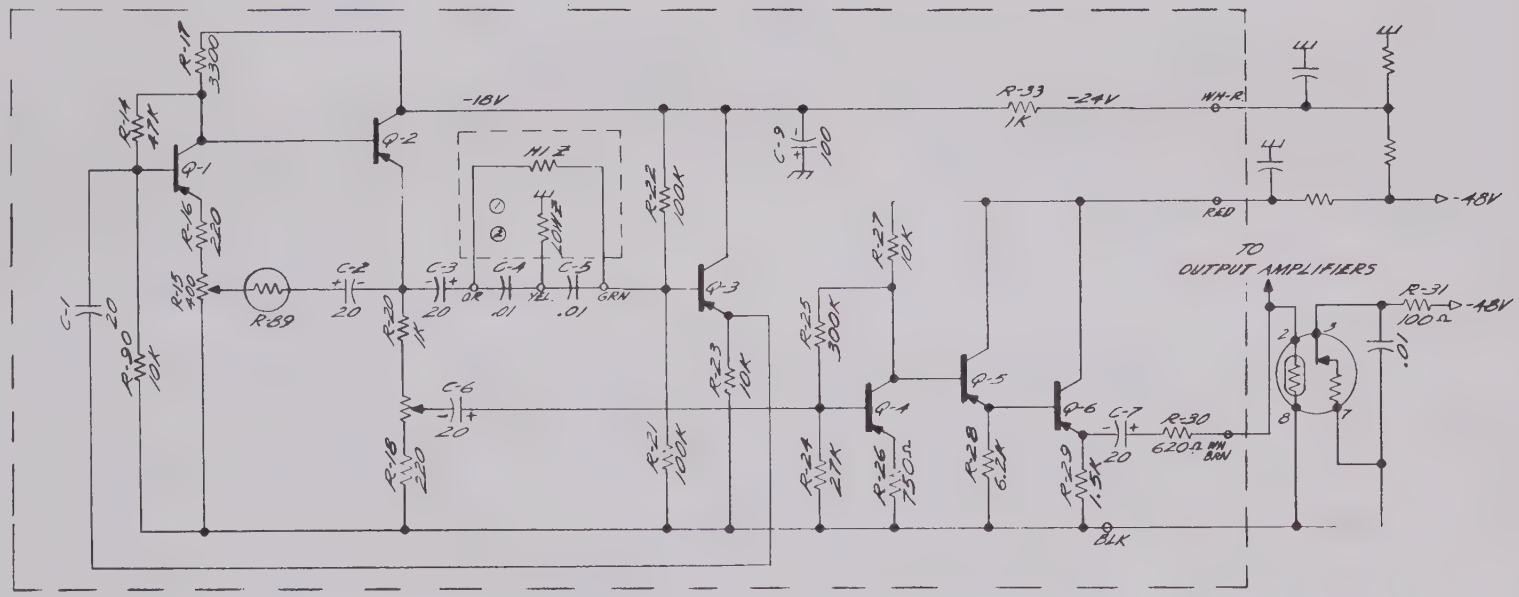
Circuit Ref	Description	Mfr* & Mfr's Designation	
TB1	Terminal Strip	8-140 3/4w	G
*NOTE:			
R18	Resistor: Fixed Composition 4.7K 5% 1/2w		B
L1	Inductor	2740J	C
K1	Relay 2500 ohm coil	RS5D	O
CR1	Diode: Silicon	1N2069	R

*NOTE: These parts used on output Module #4 only - R18, L1, K1 and CR1

TTS 39BAE

Reference Tone Generator

REVISIONS				SIZE	REV
				CONT ON SHEET	SH NO
SYM	DESCRIPTION		DATE	APPROVAL	
1	CHANGED VALUES		8-19-64	G.W.S	



NOTES:

1. SELECTED VALUES TO PROVIDE DESIRED FREQUENCY
2. OMIT FOR MULTI-FREQUENCY OPERATION

FIG. 2

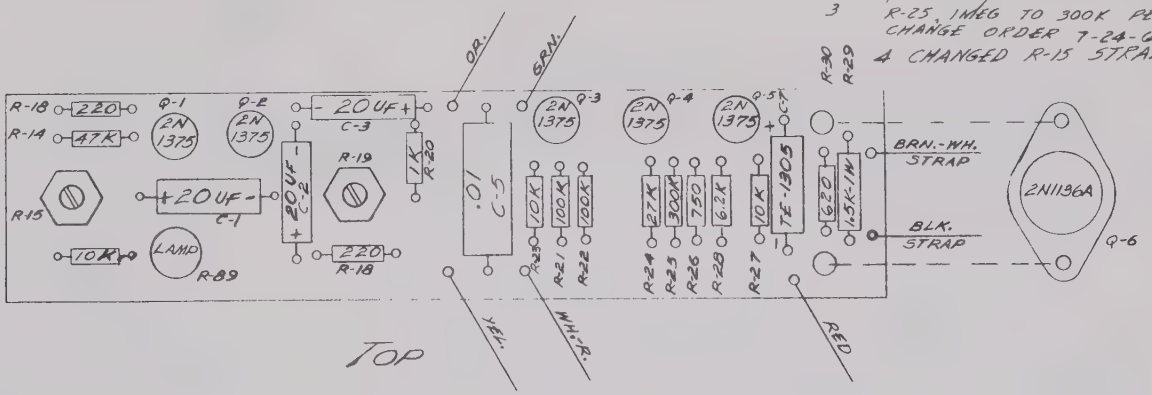
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ±1/64 DECIMALS ±.005 ANGLES ±½° ALL SURFACES	DRAWN K.A. SMITH DATE 1-10-64 APPD. ISSUED	SCHEMATIC OSCILLATOR AMPLIFIER PRINTED CIRCUIT	NORTHEAST ELECTRONICS CORP. CONCORD, N. H.
MATERIAL	APPROVED / DATE		REF. NO.
FINISH PAINT SCREEN PER	ENGR MFG MATL	SCALE WT CALC ACTUAL	SIZE B 40477 CONT ON SHEET SH NO

REV	SIZE	CONT ON SHEET	SH NO

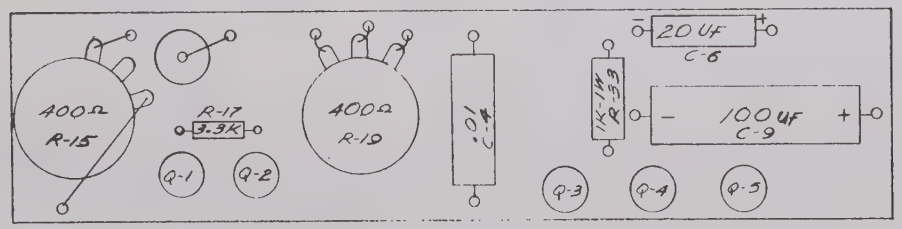
REVISIONS

SIZE	CONT ON SHEET	SH NO	RE

SYM	DESCRIPTION	DATE	APPROVAL
1	REDRAWN	10/31/62	K.A.S
2	Changed resistor values per change order 1-11-63	9-4-63	
3	R-25, 1MEG TO 300K PER CHANGE ORDER 7-24-64	8-17-64	L.B.G.
4	CHANGED R-15 STRAPPING	9-10-64	



TOP



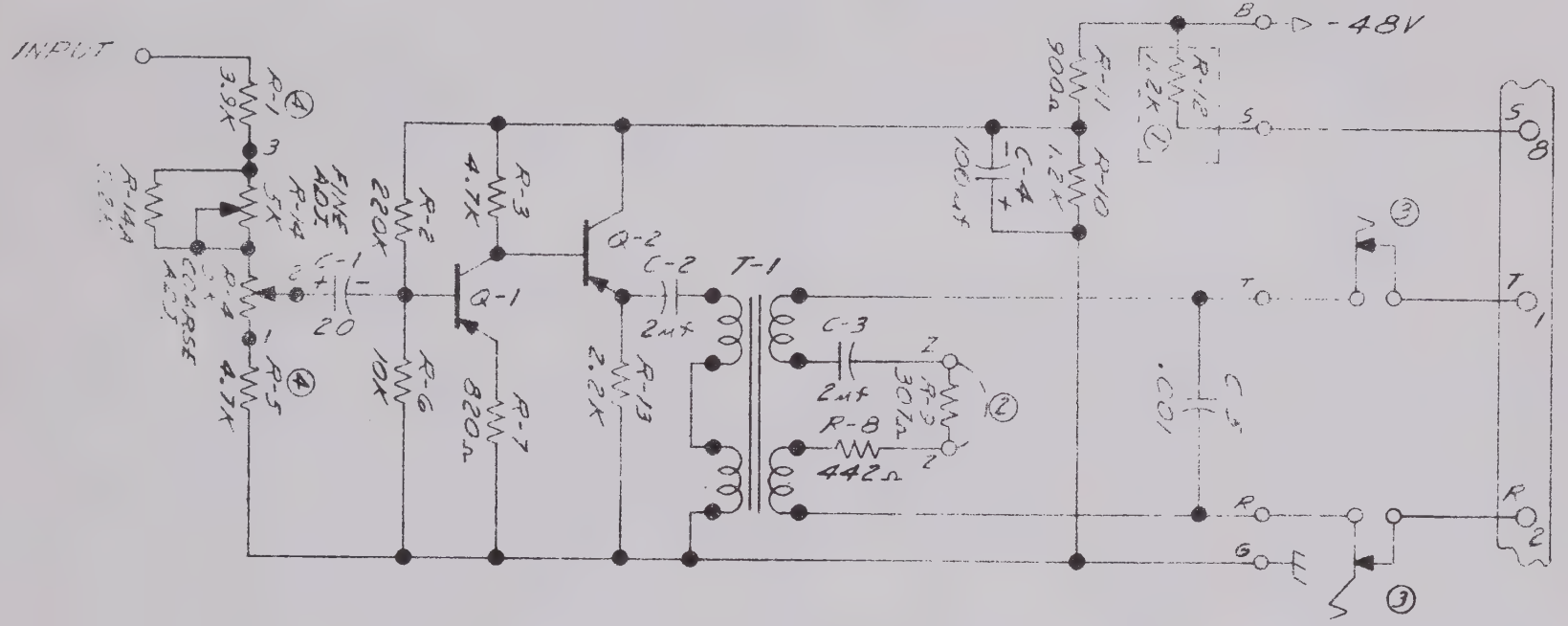
BOTTOM

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES ± 1/2° ALL SURFACES ✓	DRAWN L.B. GAGNON	ASSEMBLY	Northeast Electronics Corp. Concord, N. H.
	DATE 6-2-61	TOP P.C. BOARD	REF. B-1117
	APPD		SIZE B 40130
	ISSUED	TTS-95 AND TTS-39	
MATERIAL	APPROVED / DATE		
	ENGR		
FINISH	MFG		
	MATL	SCALE	WT CALC ACTUAL
			CONT ON SHEET SH NO.

FIG. 2A

NOTES:

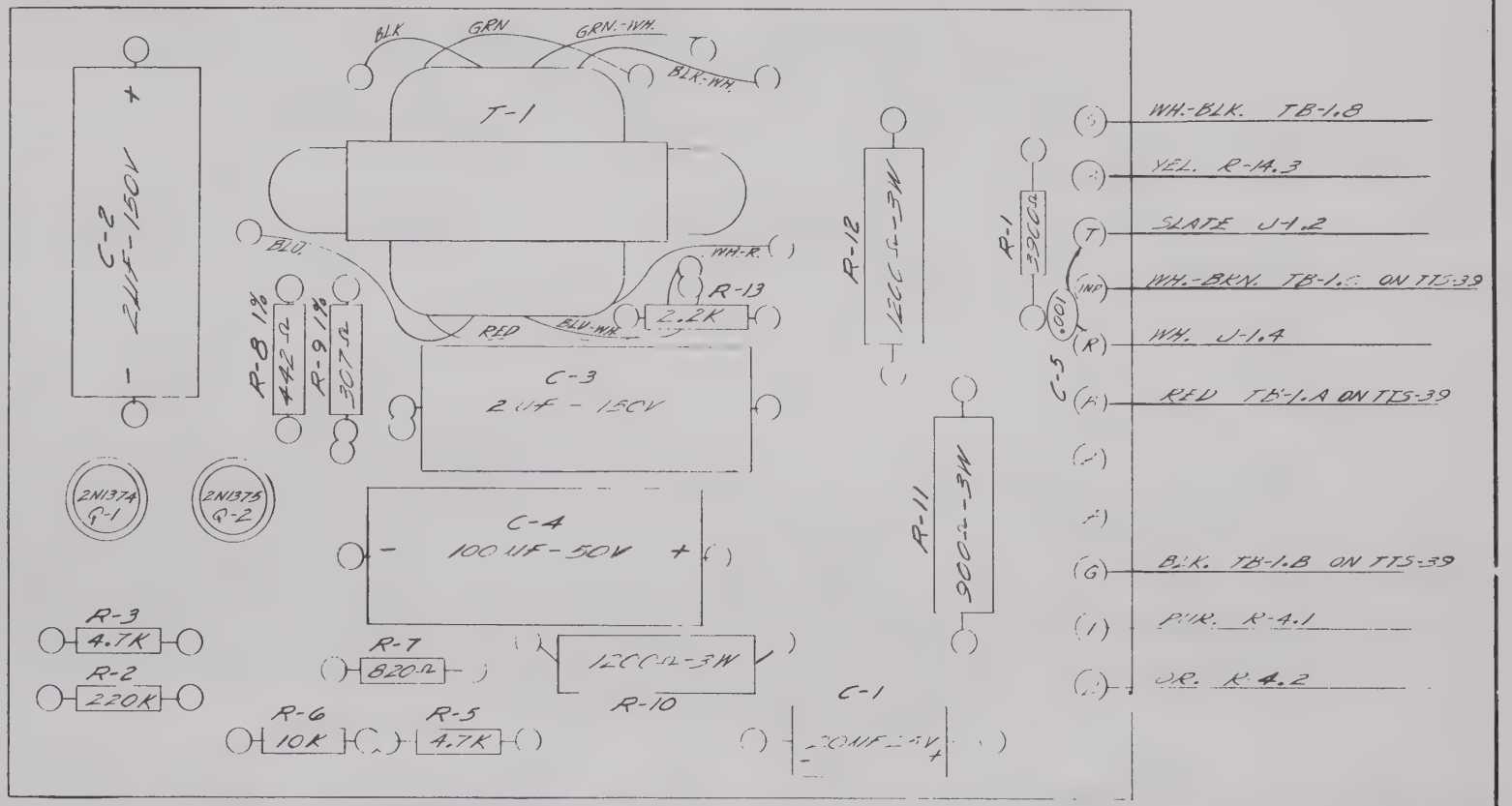
1. SLEEVE RESISTANCE NORMALLY SUPPLIED = 1200Ω.
2. INSERT STRAP FOR 600Ω, REMOVE FOR 900Ω.
3. TEST JACK.
4. VALUE SELECTED TO PROVIDE DESIRED OUTPUT RANGE.



AMPLIFIER
MODEL TTS-39XA

A-10648
FIG. 3

REVISIONS				SIZE	REV
				CONT ON SHEET	SH NO
SYM	DESCRIPTION			DATE	APPROVAL
1	CAP. ADDED PER. A1191-C01			7-28-64	K.A.S.

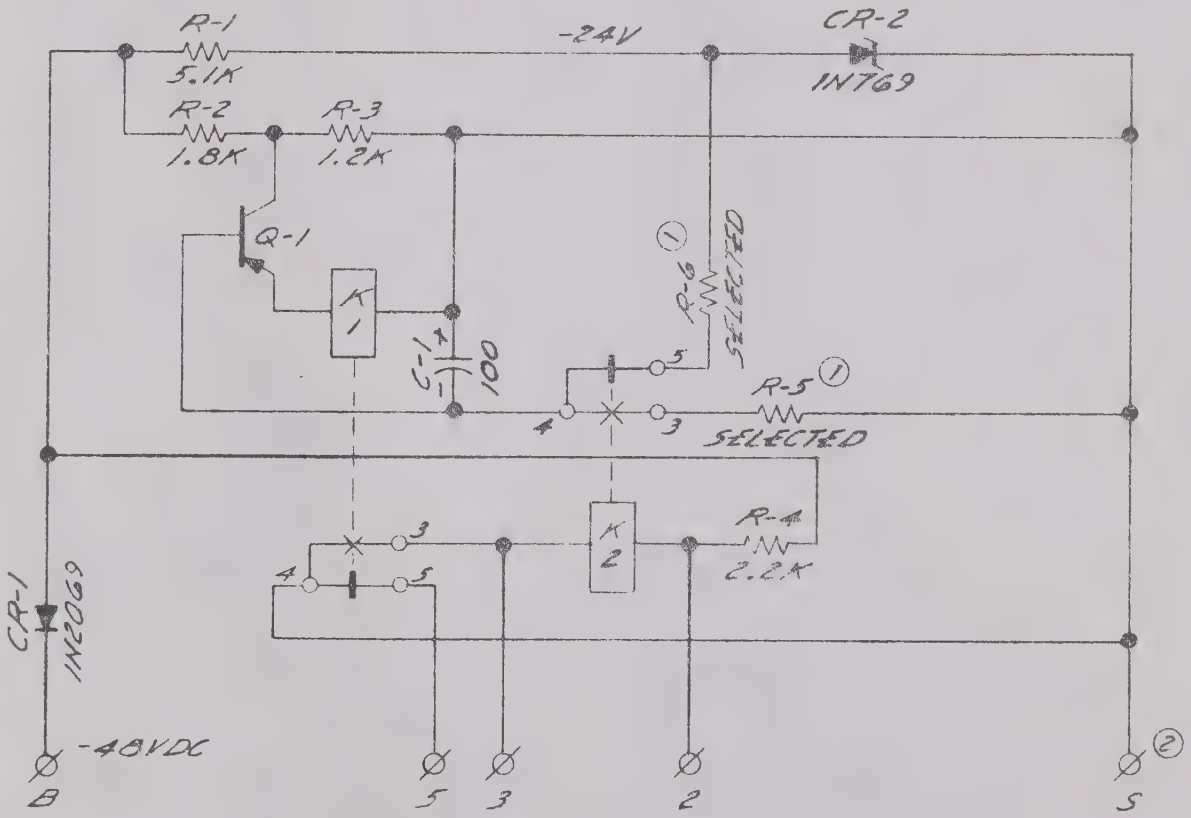


UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ±1/64 DECIMALS ±.005 ANGLES ✓±½° ALL SURFACES	DRAWN K.A.	WIRING F.C. BD.	NORTHEAST ELECTRONICS CORP. CONCORD, N. H.
MATERIAL	DATE 6-25-64	TTS-39AA	REF. NO. B-1191
	APPD		SIZE B
FINISH	ISSUED		B-10601
PAINT	APPROVED / DATE		
SCREEN PER	ENGR / MFG / MATL	SCALE	WT CALC ACTUAL
			CONT ON SHEET SH NO

FIG. 3A

NOTE:

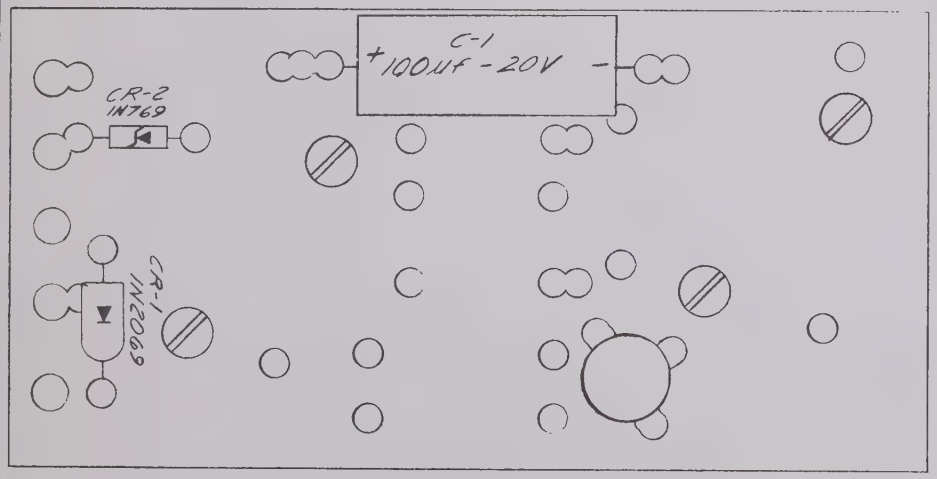
① SELECTED TO PROVIDE DESIRED TIMING.
② TO START APPLY GROUND TO TERM. "5"



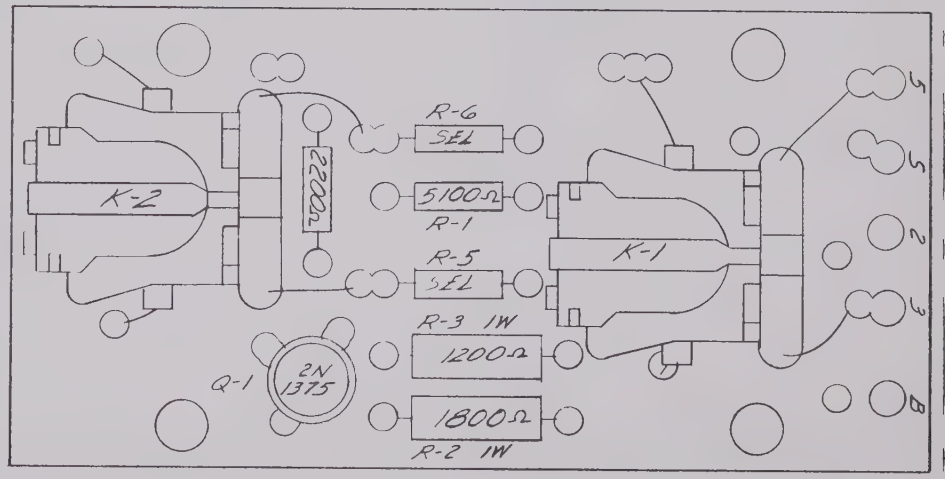
SCHEMATIC
TIME CYCLE GENERATOR

FIG. 4
A-10635

REVISIONS		SIZE	REV
		CONT ON SHEET	SH NO
SYM	DESCRIPTION	DATE	APPROVAL



REAR VIEW



FRONT VIEW

FIG. 4A

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ±1/64 DECIMALS ±.005 ANGLES ±½° ALL SURFACES	DRAWN K.A. SMITH	ASSEMBLY P.C. BOARD	NORTHEAST ELECTRONICS CORP.
MATERIAL	DATE 10-21-64		CONCORD, N. H.
	APPD		REF. NO. B-1198
	ISSUED		SIZE B 40690
FINISH	APPROVED / DATE	TIME CYCLE GEN.	
PAINT	ENGR		
SCREEN PER	MFG		
	MATL	SCALE / WT CALC ACTUAL	CONT ON SHEET / SH NO

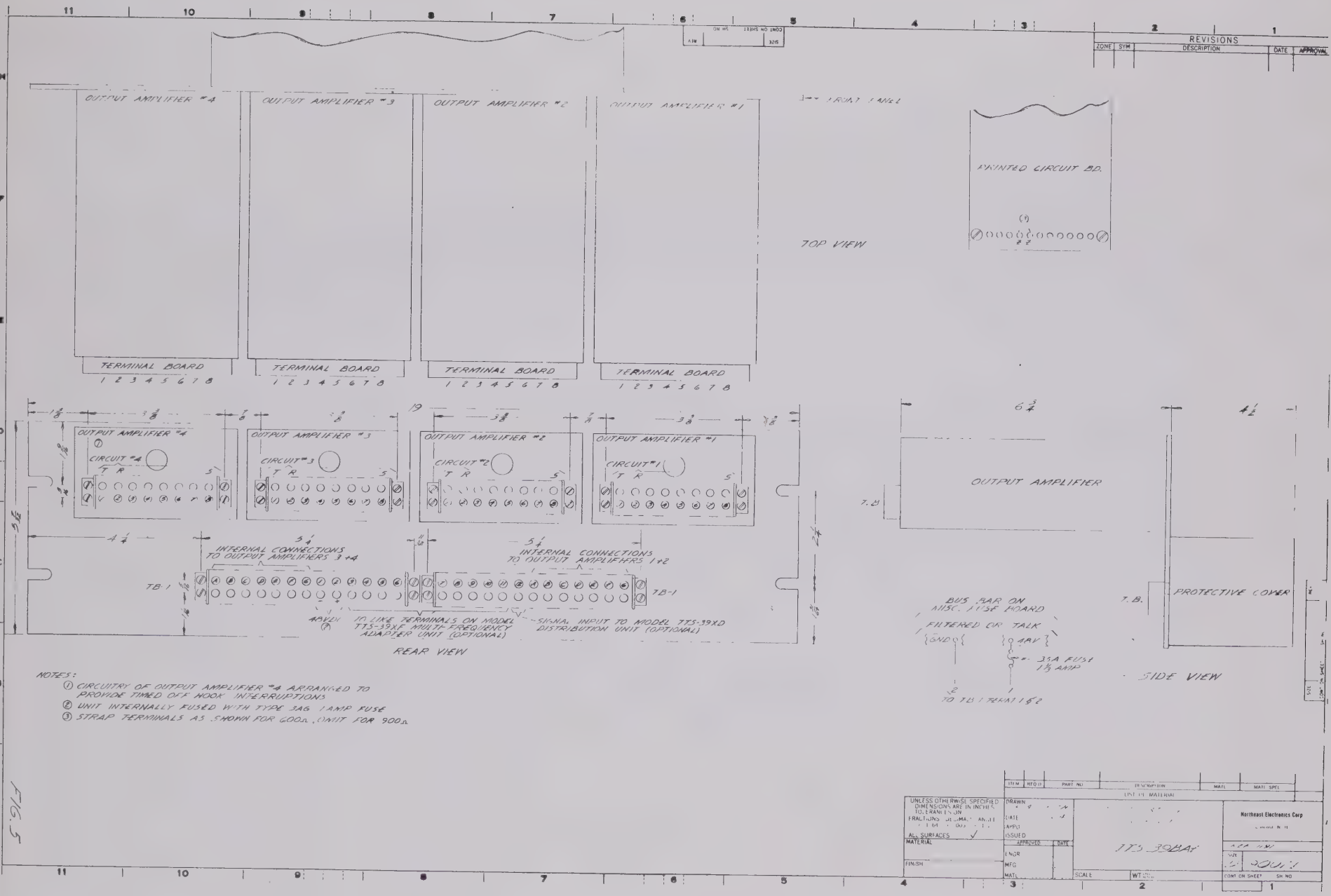

OUTPUT AMPLIFIER #4
OUTPUT AMPLIFIER #3
OUTPUT AMPLIFIER #2
OUTPUT AMPLIFIER #1
TERMINAL BOARD
1 2 3 4 5 6 7 8
FRONT PANEL
TOP VIEW
PRINTED CIRCUIT BD.
CIRCUIT #4
CIRCUIT #3
CIRCUIT #2
CIRCUIT #1
T R
INTERNAL CONNECTIONS TO OUTPUT AMPLIFIERS 3 +4
INTERNAL CONNECTIONS TO OUTPUT AMPLIFIERS 1+2
TB-1
AWG 14
TO LIKE TERMINALS ON MODEL TTS-39XF MULTI-FREQUENCY ADAPTER UNIT (OPTIONAL)
SIGNAL INPUT TO MODEL TTS-39XD DISTRIBUTION UNIT (OPTIONAL)
REAR VIEW
OUTPUT AMPLIFIER
PROTECTIVE COVER
T.B.
BUS BAR ON ANSC. 11 SE BOARD
FILTERED CR TALK
GND
-44V
3.5A FUSE 1⅓ AMP
TO TB-1 TERM 1 & 2
SIDE VIEW
REVISIONS
ZONE SYM DESCRIPTION DATE APPROVAL
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON FRACTIONS ± .ANGLES ± .XX ± .XXX ±
ALL SURFACES
MATERIAL
FINISH
DRAWN
DATE
APPD
ISSUED
APPROVED DATE
ENGR
MFG
MATL
ITEM REQ'D PART NO DESCRIPTION MATL MATL SPEC
LIST OF MATERIAL
TTS-39BAT
Northeast Electronics Corp
SCALE
WT
SIZE
SHEET
CONT ON SHEET SH NO

FIG. 5

LIST OF MANUFACTUERES CODE LETTERS

A	Arrow, Hart and Hageman
C	Automatic Electric Co.
B	Allen Bradley Co.
D	Bendix Aviation Corporation
E	Bussman
G	Cinch Jones
H	Clarostat
F	Centralab
J	Definace
I	Dialco
K	Herzog Miniature Lamps Works Inc.
L	International Electronic Industries Inc.
M	International Resistance Company
N	Northern Engineering
O	Potter Brumfield
R	Sylvania Electric Products Inc.
P	Sprague Electric Co.
Q	Switchcraft, Inc.
S	Texas Instruments Inc.
U	Transitron Electronic Co.
T	Triade
V	Veco Victory Engineering Co.
W	Little Fuse

56982